



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE DISTRIBUTION OF POPULATION: A CONSTRUCTIVE PROBLEM

By M. AUROUSSEAU

Geophysical Laboratory, Carnegie Institution of Washington

Everyone who takes an interest in public affairs feels that population presents a vital problem. We are not by any means agreed as to the precise nature of the problem nor, indeed, as to why it is a problem at all. The great majority of ordinary individuals, especially those engaged in affairs of government, have a fixed idea that it is of necessity a question of encouraging increase. In two countries, France and Holland, we find striking exceptions; but almost everywhere else in the world the birth rate is regarded as the criterion of progress, and any diminution of birth rate is looked upon with the gravest anxiety and with an utter disregard of all other statistical variations of the population. Efforts are made to encourage immigration and to foster natural increase; while Australia has gone to the length of distributing a maternity bonus in money. Many students of the matter hold, if not the reverse, at least a very different view. It is now one hundred and twenty-three years since Malthus made the greatest of all contributions to the study of population. The principles he then discovered have steadily gained ground with economists and men of science, until now some of them are regarded almost as laws of nature; yet, in spite of this, these principles have been steadily ignored by the rest of the world and, indeed, may be said to be unknown to the majority.

The state of affairs existing at the present time is sufficient to cause alarm not for the present generation but, at any rate, for the next but one. We are heading toward the crisis of not being able to provide food for our rapidly increasing numbers. The whole matter has been most lucidly and completely set forth by East, in what is evidently a summary of extensive research.¹ He shows that the white race is increasing much more rapidly than the yellow or the black. China is stationary, while India and the South Sea Islands are increasing spasmodically, probably at a somewhat slow rate. Japan is showing a steady increase. In the United States and the West Indies the blacks are increasing rapidly, and they are also increasing in South Africa; but the condition of the dark races of central Africa is doubtful. The great rate of increase of population in the United States is then considered in relation to the agricultural resources of the country. The whole exposition goes to show that, although the resources for the immediate future are ample, very serious conditions are likely to arise in a future which is not far distant. In the very month when East's paper

¹ E. M. East: Population, *Scientific Monthly*, Vol. 10, 1920, pp. 603-624.

appeared, Pearl and Reed² announced the discovery of an empirical law of population increase which is of fundamental importance. These authors treated population increase as a biological growth problem. They deduced the formula of a logarithmic parabola, which fits the curve of population growth of a country with wonderful accuracy and indicates a definite upper limit, which is given remarkable confirmation by other biological growth phenomena which may be verified experimentally. They announce a maximum of 197¼ million for the population of the United States. That the United States could not support an "enormously greater" population is the further conclusion of East who in the light of additional data reconsiders the agricultural possibilities of the country.³ He now states as his conclusion that 331 million people is the "maximum population the United States can support under any conceivable conditions to those of us who live at the present day." These investigations are an index to the most important work that has been done on the problem of population, and should do much to shake the faith of the uninformed majority, which thinks that the maintenance of an alarming rate of increase is the only possible way of keeping our place in the race of nations. The state of the world's food resources has been investigated by J. Russell Smith,⁴ who shows that by the geographical extension of areas under cultivation, by increasing yields, by new inventions and discoveries, etc., the resources now in sight may be extended to an extraordinary degree. Von Engeln, in reviewing Smith's work, points out that, although numerous means of extension *may* be available, human nature is an obstacle in the way of their utilization, and considers that our food resources cannot expand indefinitely.⁵

Mackinder has drawn attention to another great factor in pointing out that society is a "going concern" and therefore has momentum.⁶ At the present time, in spite of the recent war, three great powers are forging ahead with tremendous momentum toward the same economic objective. As three rivals cannot attain and hold the same objective, such a trend leads to conflict unless the momentum, which is largely the result of expanding population, be checked.

There is, then, a pressing problem of population, which is twofold in its nature. First, we must set ourselves to find some means of occupying the habitable lands to the best advantage; secondly, the fundamental causes of increase must be investigated, and methods of control may have to be devised and applied. The first part of the problem is largely the concern of geography, and it is my purpose in this paper to show that the means are at hand whereby we may take an active step towards its solution.

² Raymond Pearl and L. J. Reed: On the Rate of Growth of the Population of the United States Since 1790 and Its Mathematical Representation, *Proc. Natl. Acad. of Sci.*, Vol. 6, 1920, pp. 275-288. For a popular account, embodying further results, see Raymond Pearl and F. C. Kelly: Forecasting the Growth of Nations, *Harper's Mag.*, Vol. 142, 1921, pp. 704-713.

³ E. M. East: The Agricultural Limits of Our Population, *Scientific Monthly*, Vol. 12, 1921, pp. 551-557.

⁴ J. Russell Smith: The World's Food Resources, New York, 1919.

⁵ O. D. von Engeln: The World's Food Resources, *Geogr. Rev.*, Vol. 9, 1920, pp. 170-190.

⁶ H. J. Mackinder: Democratic Ideals and Reality, New York, 1919.

EXPANSION OF POPULATION

During the recent past the European countries, under intense industrial development, have been responsible for the huge expansion of the world's population. Internal pressure has caused them to seek an outlet for the overflow, and the rest of the earth has been exploited and used as a dumping ground for the surplus. Only a limited portion of the earth, however, has proved suitable for the transplanted European as a permanent home; and the temperate zones of both hemispheres have shown, in consequence, the greatest power of absorption. The emigrating peoples have not taken kindly either to the tropics or to the colder latitudes where empty spaces are available. The relief afforded the older countries by extensive emigration of their people has resulted in an acceleration of increase at home. The new occupants of the lands overseas also increase at a greater rate than they did at home, and the difficulty remains only temporarily solved. Moreover, after a time, the new states established overseas begin to feel that their own rate of increase gives them power to develop their territories independently, without further accessions of population from the home lands. This is the growing attitude of the United States at the present time. To be sure, Canada, Argentina, South Africa, and New Zealand still give a warm welcome to the immigrant and would not assent to my statement; but the attitude of labor in Australia towards immigration is somewhat hostile, and the phases through which the United States has passed may be taken as a gage of the course of events in all the newer lands. When the pressure is really felt in these lands it will enforce an expansion into latitudes which have so far been shunned. In the southern hemisphere, except to a limited extent in Argentina, people will be forced by geographical conditions to expand into the tropics.

In view of these facts it is of the utmost necessity that a complete study be made, first of all, of the present distribution of mankind, of what Jefferson has called "the distribution of men over the earth as a static fact." As data we have the vital statistics of nearly all countries, some of them eminently useful, others very poor and inaccurate. Vidal de la Blache has given the study a starting point in a qualitative way.⁷ He has summarized present conditions, noting the irregularities of distribution and the concentration in the temperate zones. He traces the origin of present conditions and distinguishes the main groups of mankind. His conclusion is that man has everywhere taken the road of least resistance, whether the resistance be climatic, topographic, or biologic, and points out that the best available land is always the first to be occupied. In a more specific manner Jefferson has outlined the precise limits of the study and has given consideration primarily to the cartographic aspect of it. He has shown clearly the value of cities as a measure of our occupation of the land and has evolved a

⁷ P. Vidal de la Blache: La répartition des hommes sur la globe, *Ann. de Géogr.*, Vol. 26, 1917, pp. 81-93 and 241-254.

method of cartographic representation of this aspect of distribution. He suggests, as an important principle, that "roughly level expanses of soil are almost more important for a great population than rainfall."⁸ These two studies are a sound foundation for future work, which must be concerned chiefly with cartographic representation. We have already a rough quantitative idea of the distribution of mankind; but much greater precision is necessary, and, above all, we need good maps.

It is not likely that mankind will ever be distributed in an even fashion over the globe, and the trend indicates that the empty areas capable of absorbing the overflow are strictly limited in extent. With a precise knowledge of the present distribution as a foundation we shall be forced to turn to the necessity of making better use of what we already have, and in order to do so we need to know the *expansion ratios* of our various lands.

THE EXPANSION RATIO

This quantity, which I believe is capable of evaluation, is defined as *the ratio of the extent to which a given area is already occupied, expressed in numbers of people, to the extent to which it may be occupied, either by lateral spreading or by internal readjustment, similarly expressed, under standards of living comparable to those of the present*. I submit that the evaluation is to be obtained by the proper delimitation of natural regions, combined with a knowledge of the grouping of the population in those regions. If the expansion ratio of an area be known, the next step is to make gradual use of the local margin which it indicates; and this is only to be brought about by educating people to the value of the information—a different matter from that of providing them with the information.

Travel in England or Scotland soon convinces one of the reality of the expansion ratio, and travel in France or Belgium indicates that its absolute value is likely to show considerable variation from region to region. In some regions we may anticipate a liberal figure, while for others it may be close to unity. Until we are able to give it a real significance and can show people why a margin exists, little advance is likely to be made. Much is known of the grouping of population, but the information is unrecorded and can only be properly gathered by familiarity with the various regions. It is not yet possible to construct a map showing those areas where people live exclusively in villages, or in small village communities, or on farms scattered half a mile apart, or three miles apart, etc.; but the information only awaits collection and interpretation. The study of natural regions is more debatable ground, and many will query what is meant by the term. The indications here also are promising and, I believe, sufficiently definite to warrant the use of the information already gained. Most satisfactory of all is the fact that we possess the organization and part of the machinery for the education of

⁸ Mark Jefferson: Some Considerations on the Geographical Provinces of the United States, *Annals Assoc. Amer. Geogr.*, Vol. 7, 1917, pp. 3-15.

the public to the value of our work. One study somewhat of the kind suggested here has already appeared.⁹ It deals with an enormous area and a great range of conditions, and its conclusions may require subsequent modification; but the results are brilliant, and the study stands alone as an able piece of pioneering work. In a more general way Mill has considered the broad question of increasing the use of our lands and recommends extensive mapping, largely of a geological nature, as the groundwork of a more natural layout of minor administrative areas. He also admits that it is necessary to secure the right sort of people, people with the power of doing work.¹⁰ Dickson has attacked the problem in another way and also recommends extensive geographical survey and mentions the need of a stock-taking of our resources and of some sort of "country planning."¹¹

The Grouping of Population

In the quantitative study of population we refer to density, distribution, and arrangement. It is necessary to understand clearly what these terms mean. Density concerns itself with the number of people per unit of area; distribution deals with the comparative study of density from area to area; and arrangement considers the way in which people are grouped. Grouping is the fundamental concept, and our representations of density and distribution are somewhat artificial methods of expressing the variations of grouping. The ordinary map showing areal density assumes an even grouping for each of its limits of area. The results do not represent the facts but, on maps of small scale, give a reasonable idea of how the earth is occupied. As most of these maps endeavor to represent the rural population and often leave the towns out of consideration, a clearer picture is given by Jefferson's town maps, the presence of a town or group of towns generally postulating a surrounding rural halo. The map that can depict grouping faithfully has yet to be devised.

URBAN AND RURAL GROUPS

For the average man the population of a country seems to fall naturally into two sections, rural and urban. The terms have definite significance for us; and, although Jefferson has insisted with perfect logic on the unity of the city and country,¹² in actual practice it is desirable to separate the two elements. A brief consideration shows that there is no sharp line of separation between them, but they represent opposite ideas to us. The townsman is a very different fellow from the countryman, and, however intimately his life may be linked with that of the latter, in a town of any

⁹ Griffith Taylor: *Geographical Factors Controlling the Settlement of Tropical Australia*, *Queensland Geogr. Journ.*, Vols. 32-33, 1918, pp. 1-67; *idem*: *The Settlement of Tropical Australia*, *Geogr. Rev.*, Vol. 8, 1919, pp. 84-115.

¹⁰ H. R. Mill: *The Development of Habitable Lands: An Essay in Anthropogeography*, *Scottish Geogr. Mag.*, Vol. 16, 1900, pp. 121-138.

¹¹ H. N. Dickson: *The Redistribution of Mankind*, *Geogr. Journ.*, Vol. 42, 1913, pp. 372-385.

¹² Mark Jefferson, *op. cit.*, p. 6.

size he seldom gives a thought to the countryman or the country. The relation between urban and rural elements may be illustrated by the analogy of an isomorphous mineral series. In the mineral series all compositions are possible for the individual, from 0 per cent B. 100 per cent A to 100 per cent B. 0 per cent A. The mineralogist, though never losing sight of the true continuity, gives different names to individuals whose compositions lie near the extremes, as forsterite and fayalite in the iron-magnesia olivine series. In the mineral series we often find that the commonest individuals have compositions, say x B. y A, which fall near the middle of the series well away from the extremes—individuals of extreme composition, or of 100 per cent purity of one component, being correspondingly rare. Population is such a series, in which the possible ranges of composition lie along the line 0 per cent urban. 100 per cent rural . . . 100 per cent urban. 0 per cent rural; only here the commoner compositions do not lie near the middle of the series but tend to approach the extremes, though they may never actually reach them. The average example represents one or the other extreme; and, if the mineralogist is able to make his distinctions in nomenclature and can still keep in mind the absolute continuity of his series, surely we are justified in making a similar separation and in terming rural those sections of the people who are spread over the countryside and are engaged in the production of the primary necessities from the soil, while the dense clusters of folk, who have no immediate interest in the production of the materials for their food and clothing or general comfort, but are engaged in transporting, manufacturing, buying, and selling them, or in educating the people, or in managing the affairs of the state, or in merely "living in town," become the *urban* section. Just as the mineralogist has to apply different methods of analysis in dealing with his extremes, the rural and urban extremes of the population series require somewhat different geographical treatment. The principles underlying the distribution of towns and cities are extensions of those governing the occurrence of farms and villages, but the extensions do not apply to the latter.

URBAN GROUPS

If the state be regarded as an organism, the towns and cities are its organs. They are brought into existence by the growing complexity of the organism. Usually they grow from small, rural beginnings, but they may be created by spontaneous action. Although a great deal of attention has been given to towns, geography does not yet seem to have got to the root of the matter in interpreting these complex and baffling groups. Most investigators have been attracted by the interest surrounding the origin and situation of towns. Origin is an unfruitful line of investigation in the old countries and leads one sometimes to nothing more satisfactory than a legend or fairy tale. Situation gives better results. Long ago Ratzel pointed out that there are two kinds of situation: *site*, or topographical situation; and *position*, or geographical situation. This distinction deserves

more prominence. It has indeed been usefully employed by some of the French geographers. Raoul Blanchard in his town studies has emphasized distinction of *site* and *situation*. Site is a rural attribute, but position belongs to urbanism. Position represents a combination of advantages—the “strategic position” of Jefferson—which are crystallized in Mackinder’s idea of “nodality.”¹³ The majority of studies of towns trends towards the cataloguing of positions, and we now have an extensive knowledge of the kinds of advantages offered by different positions.¹⁴ It has also been shown that a town may enjoy prosperity owing to its position and yet have a very poor site.¹⁵ When we examine the idea of position in an abstract way it is at once evident that function is the driving force in the life of towns. The tissues of the state (the rural folk) or mayhap the other organs demand that a function be discharged for them. A town comes into being either at a point having those characteristics of nodality which enable it to discharge that particular function to the best advantage or at a point artificially endowed with nodality. The town will continue to flourish in the discharge of its function until the state finds that it no longer requires the assistance given. The fundamental geographical relationships of towns now become somewhat clearer. In a given state we are able to discern two orders of towns, the *active* and the *inactive*. Of active towns there are six classes.

THE SIX CLASSES OF ACTIVE TOWNS

The towns and cities of the present day function towards the nation rather than the race. Within the national boundary are numerous urban groups which exist for the exercise of the following six functions: administration, defense, culture, production, communication, recreation. These terms are used in their widest sense; and, inasmuch as all towns are placed in nodal situations, many are conveniently situated for the discharge of more than one function. There is generally one phase of activity, however, which overshadows the rest.

1. The capital city is the type of town existing for the purpose of *administration*. It is often a unifunctional town and may be a conscious creation on the part of the nation (Washington, D. C., and Canberra, Australia). It should be, but often is not, situated centrally, with due regard to ease of communication, strategic advantage, and climatic conditions. The only town studies I am aware of which deal with cities in a functional way are two reviews of some of the principal capitals.¹⁶ The administrative function towards subdivisions of the national area is almost always assumed by towns

¹³ H. J. Mackinder: Britain and the British Seas, New York, 1902.

¹⁴ See, e. g., B. B. Dickinson: The Position of Towns, *Geogr. Teacher*, Vol. 1, 1901-02, pp. 97-108; Étienne Clouzot: Le problème de la formation des villes, *La Géographie*, Vol. 20, 1909, pp. 165-176; J. W. Page: The Geographical Factors Controlling the Sites of Towns, *Geogr. Teacher*, Vol. 6, 1911-12, pp. 266-270; G. G. Chisholm: The Situation of Towns as a Subject of Teaching in Secondary Schools, *Scottish Geogr. Mag.*, Vol. 30, 1914, pp. 505-518.

¹⁵ A. Allix: La position géographique des grandes villes allemandes, *La Géographie*, Vol. 29, 1914, pp. 41-47.

¹⁶ Frederick Homburg: Capital Cities, *Journ. of Geogr.*, Vol. 19, 1920, pp. 8-15; C. B. Fawcett: The Position of Some Capital Cities, *Geogr. Teacher*, Vol. 9, 1918, pp. 238-243.

important primarily for some other function but conveniently placed for administrative purposes. In a sense all towns have an administrative relation towards their own immediate areas. Some frontier and coastal towns at which customs are collected (revenue towns) are a specialized form belonging to the administrative class.

2. Towns discharging the duty of *defense* (not to be confused with self-defense, which belongs to a past age) are placed for the strategic advantages of the position and occur in definite relation to frontiers and routes. They tend to be peripheral. As types the fortress town, the garrison town, and the naval base are examples. These towns are often small and otherwise unimportant but are not always unfunctional; indeed, many of them, such as Liège, are great centers of industry. Since the failure of Antwerp, Liège, and Namur to discharge their prime function we have been confronted with a new problem in the evolution of defensive towns. Old defensive towns contribute largely to the number of inactive towns in many countries but some have retained their original prosperity by taking on new functions.

3. The university towns, many cathedral towns, and the centers of art and religion—including centers of pilgrimage—serve for the main purpose of *culture*. The term, for want of a better one, is used in rather a wide sense. These towns have no regular distribution, though many of them occur at the junctions of old routes. Their origin is very hard to trace, and the search for it often ends by unearthing a legend. As a class these towns are characterized by a remarkable capacity for retaining their vitality through long periods of time, many of them being of the remotest antiquity. Many of the English cathedral towns are entering the inactive order.

4. Cities concerned with *production* are important either for their bulk manufacture or for their particular craft. Their positions are often rigidly dictated by sources of power and, in many examples, by the presence of the necessary raw materials. In the coming age of hydro-electric power choice of position will be more elastic and will probably lead to the rejuvenation of many inactive towns which at present do not belong to this class. The climatic factor exerts an important influence in some of the textile manufactures, such as the cotton industry of Lancashire. Manufacturing cities are of relatively modern growth, but centers of craft are often ancient. Many of the cities of India arose through the Mogul custom of establishing temporary capitals, which were really immense and luxurious armed camps, draining the resources of the empire for their splendor. When the camp was moved enough craftsmen were sometimes left behind to give the site importance and vitality, which account for the existence of a city at the present day.¹⁷

5. Towns and cities acting as links in the chain of *communication* are of great variety and number, the function including all acts of transit from mere travel to the transport of goods. Many towns of this class have long been accorded a place in geographical literature, owing to their obvious economic importance. They may be classified in three groups, concerned

¹⁷ Sir H. S. Maine: *Village-Communities in the East and West*, 7th edit., London, 1913, pp. 118-119.

with the three major divisions of the main duty, *collection*, *transfer*, and *distribution*. In the first group are the centers for the handling of primary products, the depot towns of agricultural and pastoral districts, mining towns, fishing towns, and forest towns. It may perhaps be argued that these belong to the preceding class, but in this case the towns themselves are not directly concerned with the act of production: they exist for the collection of the products; the mines, fishing banks, and forests corresponding geographically to the farms and pastures of ordinary rural districts. That the mines and their towns may sometimes almost coincide in locality is only a limiting case of the idea. These towns are urban groups with more than the usual amount of the rural element in them.

The duty of transfer devolves on the market towns, fall-line towns, break-of-bulk towns, bridgehead towns, towns at the tidal limit, towns at the head of navigation, and the *entrepôt* cities. Owing to improved means of transportation, towns at the tidal limit are decreasing in importance.¹⁸ The term "head of navigation" is purely relative, as it depends upon the type of vessel considered. On the same river there may be one head of navigation for seagoing vessels, another for commodious river craft, and a third for barges, each of which fixes the position of a town.

To the third group are assigned the export and import towns (between which there is little difference) and the centers of general distribution. The last named constitute an important element, apt to be overlooked but embracing a large number of towns having no apparent function. They perform the opposite function to the depot towns of the first group and need the convenient name of supply towns. Communication, then, engages a large proportion of the towns and cities of a modern nation. These towns tend to occur in series along the great routes, on the navigable rivers, and on the coasts. Most important of them all are the great *entrepôt* cities, the relations of which are international. Concerned chiefly with the wholesale transfer of goods and traffic from opposite directions, they are also deeply involved in the work of collection and distribution and embrace the characteristics of the whole class. They are often of quite modern growth.

6. The sixth functional class, which exists for the purpose of *recreation*, includes the health, tourist, and holiday resorts. These towns occur at points offering some strong or novel attraction of climate, scenery, or social conditions. Seasonal prosperity is their most noteworthy character. Many of them are of recent growth, and their activity is liable to fluctuation.

Table I renders clear the relationships expressed in the preceding pages but must not be regarded as a rigid classification. Geography is not a subject in which the ordinary classifications of science are either possible or desirable. The best that can be done is to provide a way of regarding things that shall be as natural as possible, enabling a clear appreciation of relationships to be made. The table, for instance, is constructed on a unifunctional basis, but it is sometimes difficult to decide which, of the several functions

¹⁸ E. C. Semple: *Coast Peoples*, *Geogr. Journ.*, Vol. 31, 1908, pp. 72-90 and 170-187.

a plurifunctional city may have, is the most important. The dangers of the rigid attitude have been dealt with by Chisholm.¹⁹

The true significance of towns and cities cannot be fully expressed in formal terminology. A review of several large cities of the same order of importance illustrates this point. London, a capital city and an international *entrepôt* city of the first rank, appeals to us as the chief mouth of Great Britain. Paris, essentially a capital and a city of international intercourse, is the

TABLE I—THE ACTIVE ORDER OF URBAN GROUPS, TABULATED ACCORDING TO DOMINANT FUNCTIONS

CLASS I—ADMINISTRATION	CLASS II—DEFENSE	CLASS III—CULTURE	CLASS IV—PRODUCTION
Capital cities Revenue towns	Fortress towns Garrison towns Naval bases	University towns Cathedral towns Art centers Pilgrimage centers Religious centers	Manufacturing towns Craft centers
CLASS V—COMMUNICATION			CLASS VI—RECREATION
<i>Group A—Collection</i>	<i>Group B—Transfer</i>	<i>Group C—Distribution</i>	
Mining towns Fishing towns Forest towns Depot towns	Market towns Fall-line towns Break-of-bulk towns Bridgehead towns Tidal-limit towns Navigation-head towns	Export towns Import towns Supply towns	Health resorts Tourist resorts Holiday resorts
"ENTREPÔT" CITIES			

Compare this table with the table of rural groups, *Geogr. Rev.*, Vol. 10, 1920, p. 239.

head of France in the physiological sense ("the lucid French people, in its brain town of Paris"—Mackinder). Berlin is a capital but more a city of internal than of international intercourse and was regarded as the control center of the former German Empire. New York, of the same order of magnitude, is not a capital but is a great center of trade and traffic and stands for the outsider as the gateway and business office of the United States.

THE DECLINE AND REJUVENATION OF TOWNS

The chief factors that may lead to decline at the present day affect principally the towns of defense, production, and communication. The first class, in its present form, may suffer general decline owing to its incapacity

¹⁹ G. G. Chisholm: Generalisations in Geography, Especially in Human Geography, *Scottish Geogr. Mag.*, Vol. 32, 1916, pp. 507-519.

to resist modern weapons. The productive towns are mainly influenced by changes in the sources of power. Towns which flourished on water power declined on the advent of coal and steam; and, in their turn, some modern manufacturing towns may be threatened by the development of hydro-electric power. Exhaustion of raw material acts rapidly on the mining towns, as is shown by the number of extinct mining centers in regions like Nevada, Colorado, and Western Australia. Similar results may be seen in the case of lumbering. The recent war has emphasized another aspect of the question in the deprivation of raw material, affecting the manufacturing cities that draw their supplies from beyond the seas; this is illustrated by the Manchester cotton famine. The towns and cities of communication depend upon their adaptability to the vehicles of transport. It is unnecessary to dwell on the effects of railways and canals, but the increase in the size of ships has had far-reaching effects in developing harbor towns at the expense of towns at the tidal limit or head of navigation. Changes in the vehicles of transport may bring about a shifting of the great routes, which will cause the decline of many towns.

Inactive towns may discover, after a long period of inactivity, that they are capable of reviving their usefulness. If the new function differs from the old, the rejuvenated towns may be termed *epifunctional* towns. We may look to hydro-electric power to rejuvenate a number of inactive towns in the near future. The effects of aerial communication are not yet apparent, but the rejuvenation of a few arrival and departure stations may be expected.

RELATED TOWNS

It happens not infrequently that the rise of one city calls a neighboring town into greater activity, and the two become interdependent. The decline of the first may also entail the decline of the second. The most familiar example is the group Paris-Rouen-Le Havre. The group Koseir-Thebes-Kharga is an example from antiquity. The groups of small ports which screen a city to the rear on many parts of the English coast²⁰ are another illustration of related towns and of their decline.

THE VULNERABILITY OF TOWNS

Prosperity is controlled by the great trade routes and avenues of intercourse, which in their turn are lines of easy movement. Facility for movement also means facility for invasion, and hence it is submitted that vulnerability is an inherent character of urban groups. The fortress towns themselves have merely the power of resisting offense for a longer time than their companions. Power of resistance is further decreased by the fact that few modern cities are able to exist upon supplies drawn from their immediate neighborhood. Lines of water supply are often of great length, Los Angeles

²⁰ H. J. Fleure: *Human Geography in Western Europe (The Making of the Future)*, London, 1918, pp. 52-53.

being a familiar illustration; but Kalgoorlie, Western Australia, probably holds the record with a pipe line 380 miles long. So great is the vulnerability of towns, that in the warlike times of the past many European towns, then much more closely related to the rural folk than now, were forced to occupy hilltops as a measure of security.²¹ Vulnerability is not only of military significance: by their nature towns are liable to be the victims of infection either physical or psychological.

THE MORPHOLOGY OF TOWNS

The aspect of the town, its architectural character, and its general layout are matters of some importance for our present scheme. This character tends to vary from region to region and may be an expression of the *genius loci*. Much that is of importance to the town planner and improver may be learned from the results of regional study such as Fleure has recently made.²² His paper suggests that the character of the town varies regionally in the same way as the grouping of the rural folk.

It is well known that towns have an extraordinary power of growth. This appears to be due to the relation between the primary occupations and the secondary occupations of the townfolk. The primary occupations are those directly concerned with the function of the town. The secondary occupations are those concerned with the maintainance of the well-being of the people engaged in those of primary nature. The more primary citizens there are, the more secondary in a relation something like compound interest. Moreover, there are certain profits, especially in the way of amusements, to be made out of both classes. This has to be considered if the limitations of the town growth are to be studied.

THE TOWN

The study of the individual town lies on the border line between geography and town planning. Each town presents its own problem and has its own method of development. Some very important pieces of intensive work have been done on the individual town,²³ but few general principles are discernible. The town often shows a natural division into an area of work and an area of residence, but there is an intergrowth between the two in many examples. Where they are distinctly separated there are attempts to reduce the distance or to increase the speed of the journey for the daily ebb and flow, without additional expense to the individual. Site becomes a matter of interest; but physiographic control of city growth is usually of a negative kind, the average town site permitting indefinite lateral expansion. In a few rare examples, like New York, restriction of space has brought about

²¹ See such works as E. M. Fryer: *The Hill-Towns of France*, New York, 1917.

²² H. J. Fleure: *Some Types of Cities in Temperate Europe*, *Geogr. Rev.*, Vol. 10, 1920, pp. 357-374.

²³ E. g., Lucien Gallois: *Quelques études de villes*, *Ann. de Géogr.*, Vol. 21, 1912, pp. 294-311. See also "Urban Geography: A Study of German Towns" in the Record section of this number of the *Review*.

an inordinate upward growth. Many French and Italian towns offer a sharp contrast to the sprawling tendencies of English towns and show that spaciousness and compactness are not incompatible and that restriction of area is to a certain extent desirable owing to the increased facility it gives to communication.²⁴ Cities like Antwerp show clearly that it is not inevitable that towns should gradually swallow up the countryside. At the same time the huddled compactness of many epifunctional towns in Europe is an undesirable survival of an obsolete necessity.

SEMIURBAN GROUPS

The only region known to me which bridges the gap between country life and town life is the semiurban country of southern Belgium. The semi-urban effect produced in the Mons-Courcelles-Charleroi coal field has there solved the difficulty of the "black countries" in a most satisfactory manner; but it is not of evolutionary origin. It was brought about by special legislation, in which the people themselves participated actively.²⁵ It shows, however, that if the example is going to be copied on an extensive scale a large amount of land will be rendered useless for fundamental agriculture. Small garden holdings may produce vegetables and fruit in plenty, but they do not produce wheat.

RURAL GROUPS

I have dealt at some length with the subject of rural populations in a previous paper,²⁶ to which the reader is referred for further detailed information: a brief recapitulation with a few additions is given here. In order to appreciate the full meaning of the rural groupings and to understand the changes through which they have gone or may go in the future, it is necessary to trace their origins. I have found that among the old and established peoples social organization is the dominant factor affecting the grouping in the beginning. With the gradual progress of the race or state it gives way to some form of economic organization; and not until there is a comparatively full degree of personal freedom does the grouping become a suitable adaptation to geographic surroundings. I now believe that further change in economic conditions, resulting in pressure from within, may bring about a reversion from the last and freest grouping to a kind primarily dependent upon space economy, and I will quote the Shantung Province of China as an example. The earlier stages impose a clustered grouping. With the attainment of freedom dispersions may result, if the geographic conditions be favorable, and ultimately space economy may cause reversion to a clustered grouping. I refer to community systems as economic organizations and to the villa and the manorial systems or other feudal systems, as social.

²⁴ Town Housing, *London Times Literary Suppl.*, May 21, 1920, pp. 309-310.

²⁵ R. C. K. Ensor: Belgium (Home University Library), New York, 1915, pp. 196-203.

²⁶ M. Auroousseau: The Arrangement of Rural Populations, *Geogr. Rev.*, Vol. 10, 1920, pp. 223-240. See also "The Arrangement of Rural Population in Belgium" in the Record section of this number of the *Review*.

Tribal and clan systems are likewise social in their nature, and so is segregation for defense. The Russian mir is an economic group, for the Russian peasant of the steppes and forests was a serf socially before the war—whatever he may be now—in spite of his local agrarian freedom. Thus in England and France (though not universally) the following was the course of events:

Manor or villa ➡ *Village community* ➡ *Geographical grouping*

We know little of what preceded the feudal organization. In the newer lands the occupation is generally appropriate to the conditions, though defense may cause temporary clustering; and in the early settlement of the United States democratic ideals caused the foundation of village communities. The transitions may have been enforced by legislation or may have been voluntary movements. At the present time all three stages are to be seen in different countries, so that the adjustment to geographical conditions is far from complete.

The groups themselves form a series somewhat like the population series of an earlier section. The extremes here may be fairly clear-cut, but the intermediate stages are also comparatively common. The variation is along the line:

Cluster ➡ *Partial agglomeration* ➡ *Incomplete dissemination* ➡ *Dispersion*

The adjustment to geographical surroundings may cause the tendency of the primitive cluster towards dispersion to stop at any point along the line; in other words, it is not always possible to achieve dispersion, as numerous geographical factors do not permit of its development. The principal kinds of groupings have been described in my earlier paper. The following additions are necessary.

ADDITIONAL FORMS OF GROUPING

1. Agglomerations. A. *Linear clusters*. In the early settlement of parts of New England the need for defense caused segregation into villages. The villages were placed close to the banks of streams, with a main street parallel to the stream. Houses lined the main street, and the farm lots stretched back from the houses in the form of long, narrow strips. This form of holding facilitated plowing; and, although the need for defensive organization has now passed, the farms of ribbon form are still to be seen in many places. The neighborhood of Hatfield, Mass., in the Connecticut Valley, where onions are cultivated, is an example. The St. Lawrence littoral below Quebec is another. The strips may be 200 yards wide and a mile long.

B. *Transplanted villages*. A sudden change in culture, leading sometimes to a modification of surroundings by man, causes the removal of villages from the old sites to new and more suitable ones. My examples are all from early, perhaps Neolithic, communities. The early occupation of Salisbury Plain (England), was in the form of defensive clusters.

placed on hilltops overlooking the valleys. These were transplanted to the sites of the present valley villages, probably as soon as the clearing of the valley forests became possible. A similar change took place in pre-dynastic Egypt, where the villages were at first confined to the higher ground of the valley sides. When it became possible to till the alluvial ground satisfactorily the villages were transferred to the flood plain. The Alpine lake dwellings of Neolithic Europe underwent a similar transplantation, particularly in parts of Piedmont.²⁷ The cliff dwellings of the Pueblo Indians also appear to have been forsaken for the present village sites on the tops of the mesas, if the existing folk are the descendants of the cliff dwellers.²⁸

C. *Spring line villages*. In my former paper I distinguished a group of marginal girdle villages. As this term links a definite form of occurrence with a definite type of calcareous formation and allows of the prediction of its development elsewhere, the term is a desirable one. For the common and well-known strings of villages occurring on the spring line between water-bearing and non-water-bearing formations regardless of the presence of widespread calcareous formations, the current designation of spring line villages should be retained to indicate the more general type of control. Ogilvie records this type in Macedonia.²⁹

2. Disseminations. A. *Hilltop dispersion*. In parts of Maine, where dispersion has developed, houses are sited on the hilltops, thus avoiding the coldness and night fog of the valleys. This indicates an additional controlling factor in rural grouping.

B. *Dispersions of different density*. It appears to be necessary to regard dispersions of wide interval as different forms from the denser types. The widely scattered farms of the wheatlands of the Canadian prairies are not under precisely the same geographic influence as the more closely disposed farms of the cornlands of Ohio and Indiana, and these again differ from the closely packed farmhouses of regions of intense culture like Flanders.

So far we have dealt only with sedentary rural groups. These are the normal types in regions responsive to man's agricultural efforts (Dr. Fleure's "regions of increment" and "regions of effort"). In many mountainous regions ("regions of difficulty") semi-mobile groups are found, as in the Alpine valleys of Europe, where permanent sets of dwellings are constructed for occupation at different times of the year. On the borders of the hot deserts similar groups are found, occupying movable structures, as in Algeria. In "regions of wandering" all groups are mobile (nomadic), and the dwelling is always portable.³⁰ We have therefore another rural series: Sedentary, Semi-mobile, Mobile.

²⁷ See J. L. Myres: *The Dawn of History* (Home University Library), New York, 1911.

²⁸ For an account of the Pueblo Indians and the cliff dwellings see *Handbook of American Indians North of Mexico*, 2 vols., *Bur. of Amer. Ethnology Bull.* 30, Smithsonian Instn., Washington, D. C., 1907 and 1910.

²⁹ A. G. Ogilvie: *Physiography and Settlements in Southern Macedonia*, *Geogr. Rev.*, Vol. 11, 1921, pp. 172-197.

³⁰ For a highly developed type (the Kirghiz) see Ellsworth Huntington: *The Pulse of Asia*, Boston, 1907, pp. 106-132.

The main factors underlying the grouping of rural peoples are now capable of enumeration. They are: social organization; economic organization; the limits of possible pursuits in each region; the ground-water, rainfall, and surface-water conditions; the quality of the soil; the minimum size of holdings in each area; local weather conditions; local topographic conditions; and space economy.

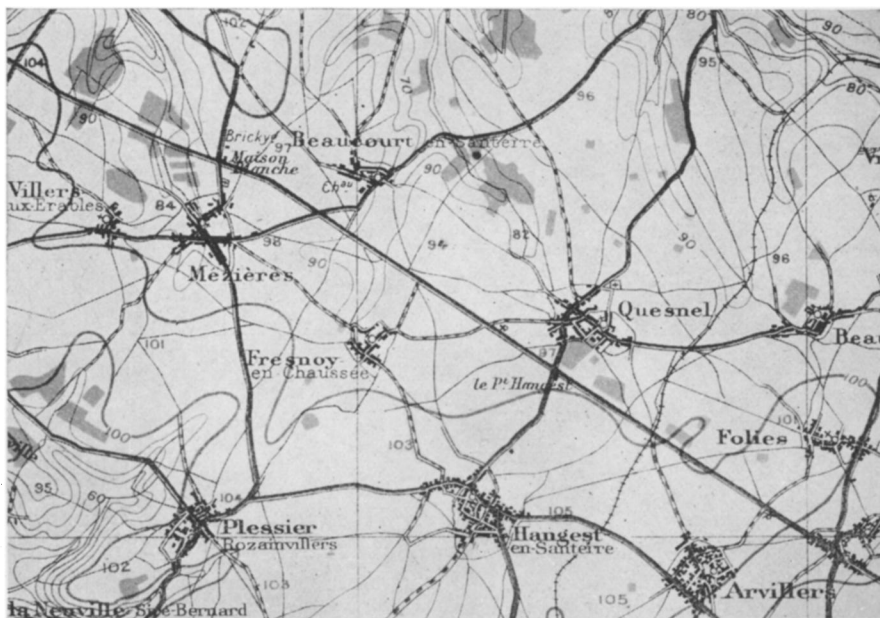


FIG. 1—A type of agglomeration, lime-land (*wet point*) villages southeast of Amiens. This and Figures 2, 3, and 4 are reproduced from the British General Staff map of Northwestern Europe. Scale 1:100,000. (Amiens sheet.)

THE SIGNIFICANCE OF SOCIAL ORGANIZATION AND LAND-TENURE SYSTEMS

Early social organization is of widespread and lasting influence. Morgan, in studying the house types of the American Indians, based his whole scheme upon social organization,³¹ and, generally, the more primitive the community the more powerful is the influence. It affects later systems mainly by exerting some control upon the system of land tenure, and many usages in Europe are traceable to old social organizations,³² such as the mark system and the manorial system. Fustel de Coulanges³³ does not admit the existence of the mark system and criticizes its German proponents scathingly; but Stubbs and Ashley (see my previous paper) consider that it existed in some form in many parts of early Europe. For the latter sys-

³¹ L. H. Morgan: *Houses and House-Life of the American Aborigines* (Contributions to North American Ethnology, Vol. 4), Washington, D. C., 1881.

³² William Stubbs: *The Constitutional History of England*, 2 vols., 6th edit., Oxford, 1903, Ch. 3.

³³ N. D. Fustel de Coulanges: *The Origin of Property in Land* (translated by Margaret Ashley), 2nd edit., London, 1892.

tems the reader is referred to the authorities quoted in my previous paper, and to the articles on "Village Communities" and "Villénage," by Sir Paul Vinogradoff, in the *Encyclopaedia Britannica*. The influence of old usages in America has been very carefully investigated by Fiske.³⁴ If any transitions are to be effected in rural grouping, in the development of our lands, land tenure is likely to be one of the most difficult obstacles in the way, titles

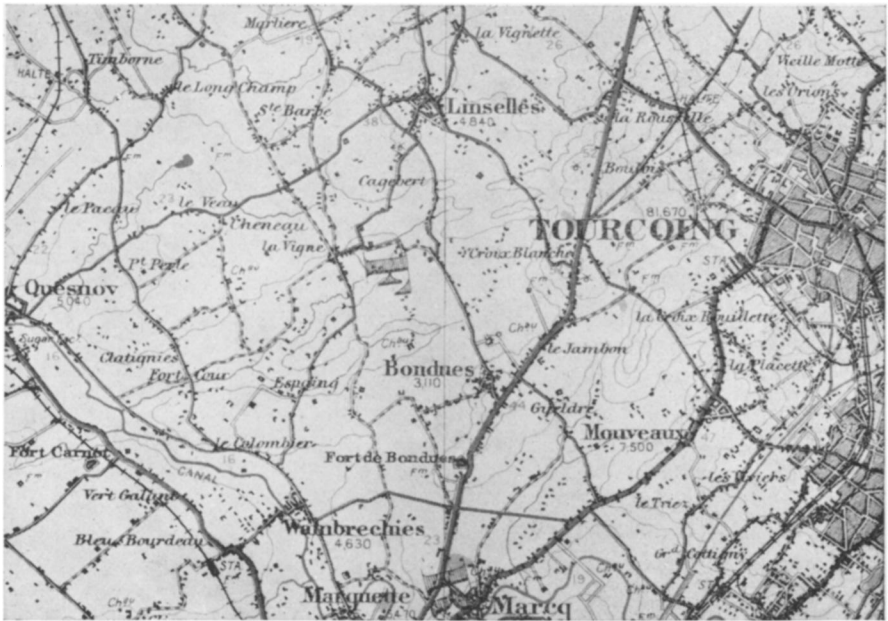


FIG. 2—An illustration of complete dissemination; north of Lille. (Tournai sheet.)

having their roots in the distant past. More comparative studies of land tenure are needed.³⁵ The whole question of further subdivision depends upon it.

Natural Regions

There seems to be no agreement at the present time on the subject of natural regions. Numerous descriptions exist dealing with regions obviously of quite different status, but all pass under the same name. Some writers hesitate to delimit the regions, while others assert that they are not capable of delimitation. Others still do not hesitate to divide large tracts of country into regions on various bases. I shall here review some of the more important examples, in an attempt to effect a measure of co-ordination. From a study of numerous papers dealing with the subject I believe that, for the present purpose, there are four kinds of natural regions mutually related by subdivision or combination. The delimitation of the region becomes easier as

³⁴ John Fiske: *American Political Ideas*, Boston and New York, 1911; and in other writings.

³⁵ Such as "Systems of Land Tenure in Various Countries" (Cobden Club Essays), new edit., London, 1881.

its size diminishes, and an ultimate delimitation of the larger regions will only be possible when our knowledge of the smaller types is more fully established. Jefferson has questioned the possibility of assigning boundaries to natural regions, on the grounds that geographical separations are never *lines* (Jefferson, *loc. cit.*); but this does not render impracticable the delimitation of natural regions if we remember that the boundaries of delimitation are *zonal* in character, while only boundaries of demarcation are lines. Fawcett's study of frontiers is applicable to many other aspects of geography besides the immediate one.³⁶ The four kinds of regions which I wish to distinguish are: world regions, climatic regions, physiographic provinces, and natural districts. They are listed in descending order of size, and the



FIG. 3.—An illustration of linear dissemination; southwest of Avesnes. (Valenciennes sheet.) Scale reduced to 1:130,000.

dominant element making for unity of aspect and influence becomes of wider and wider distribution in ascending the scale, the region of larger size becoming more and more heterogeneous in character with respect to the elements of restricted range and less capable of precise demarcation though not necessarily of fairly sharp delimitation. Fenneman in dealing with physiographic divisions has already proposed a nomenclature on the order of the above for regions of different status.³⁷ The dominant influences in these four classes of regions are, respectively, position, climate, configuration, and geology. It is not assumed that any of them acts alone, and each connotes a number of subsidiary influences. All are operative in every region, regardless of status, but to a degree that makes one of them a dominant influence.

³⁶ C. B. Fawcett: *Frontiers: A Study in Political Geography*, Oxford, 1918.

³⁷ N. M. Fenneman: *Physiographic Divisions of the United States*, *Annals Assoc. Amer. Geogr.*, Vol. 6, 1916, pp. 19-98.

WORLD REGIONS

The concept of world regions has been put forward by Mackinder.³⁸ The world regions are the World Island and its subdivisions into Heartland and Coastlands, the satellites of the World Island, and the World Ring. The influence of these regions is more apparent when the course of history is followed, than it is from a mere material survey of the world. That they are of real influence cannot be doubted, nor can the fact that they place definite limits to our activities and distribution. Mackinder has delimited some of the boundaries of the subdivisions of the World Island with considerable precision, and we may hope for a still more exact delimitation.



FIG. 4—A type of agglomeration; *spring-line* villages south of Rheims. (Rheims sheet.) Scale reduced to 1:130,000.

CLIMATIC REGIONS

A subdivision of the surface of the globe into regions on the basis of rainfall, temperature, elevation, and relation of the land to the sea, with other contributing factors, has been made by Herbertson and by Unstead and Taylor. The first-named has published his results in the form of papers and has later incorporated them into his textbooks. The latter authors have announced their results in textbooks.³⁹ There is a general agreement between the maps of both authorities, the points of difference being concerned mainly with the question of delimitation. The accord as to the general

³⁸ *Op. cit.*: footnote 6. See the discussion by C. R. Dryer: Mackinder's 'World Island' and Its American "Satellite," *Geogr. Rev.*, Vol. 9, 1920, pp. 205-207.

And see also F. J. Teggart: Geography as an Aid to Statecraft: An Appreciation of Mackinder's "Democratic Ideals and Reality," *ibid.*, Vol. 8, 1919, pp. 227-242.

³⁹ A. J. Herbertson: The Major Natural Regions: An Essay in Systematic Geography, *Geogr. Journ.*, Vol. 25, 1905, pp. 300-312; *idem*: The Higher Units, A Geographical Essay, *Scientia*, Vol. 14, 1913, pp. 199-212; J. F. Unstead and E. G. R. Taylor: General and Regional Geography for Students, 1st edit., London, 1910. See also other textbooks by the same authors.

character of the regions is sufficient to justify the belief that the subdivision is real and natural, in spite of the opposition displayed towards Herbertson's scheme when his first paper appeared. Griffith Taylor has put Herbertson's principles into application, having divided Australia into rainfall regions, on the bases of the amount of rain, the character of its fall, and relation to the sea.⁴⁰ Owing to the general low relief of Australia, elevation sinks to a place of minor importance. The regions do not accord with the details of Herbertson's classification but correspond well with his scheme. The subdivisions are eminently satisfactory; and Taylor, recognizing that precise delimitation is not yet possible, has indicated the boundaries by arbitrary straight lines. Our belief in climatic regions appears to be justified.

PHYSIOGRAPHIC PROVINCES

Fenneman (*loc. cit.*) has undertaken the subdivision of the United States into regions on a physiographic basis; material, structure, process, stage, etc., being the criteria employed. The results are indicated on a map. The resulting regions are for the most part of large size. I would class with this study the similar work of Cvijić, Lemoine, and Blanchard.

Cvijić⁴¹ has subdivided the Balkan Peninsula on the basis of the human opportunity of union and penetration or the opposite, inhibitory effect of isolation and separation. These factors, in the regions considered, depend ultimately upon configuration. He distinguishes two groups of regions; the first an Aegean region, which is divisible into two subregions; the second a continental block, divisible into three regions, which in their turn fall into two, four, and six subdivisions respectively. Some of these regions are very well defined indeed, and the results have been interpreted on a map by the *Geographical Review*. The effects of relief appear to be dominant throughout; but what is important for my purpose is that the two groups appear to be separated by a climatic boundary.

Lemoine studied the department of Gard, France.⁴² He divided his area into three principal regions on the basis of configuration and subdivided one of them into two geological regions. The influence of climate is never absent. Lemoine gives a geological map of the area but makes no delimitation of his regions upon it, indicating their location merely by lettering.

Blanchard has given us two important studies of this kind. He treats Flanders⁴³ as a "natural" region. The unity of aspect of Flanders, I know from personal experience, is purely physiographic. Further subdivision is possible, on geological grounds, and this Blanchard clearly shows, noting the grades of difference between East and West Flanders and between the dunes and "pannes" of the coastal strip. The *moères* are another sub-

⁴⁰ Griffith Taylor: The Australian Environment (Especially as Controlled by Rainfall), *Commonwealth of Australia Advisory Council of Science and Industry Memoir No. 1*, Melbourne, 1918.

⁴¹ Jovan Cvijić: La Péninsule Balkanique: Géographie Humaine, Paris, 1918; The Natural Regions of the Balkan Peninsula (after Cvijić), *Geogr. Rev.*, Vol. 9, 1920, pp. 199-204.

⁴² Paul Lemoine: Les régions naturelles du département du Gard, *La Géographie*, Vol. 27, 1913, pp. 197-202.

⁴³ Raoul Blanchard: La Flandre, Paris, 1906; and Flanders, *Geogr. Rev.*, Vol. 4, 1917, pp. 417-433.

region. The separation of Flanders from the regions to the north is partly climatic. On the southwest there is a sharp geological and physiographic boundary. On the south the boundary is physiographic and not so well defined.

Blanchard's treatment of the French Alps is one of the most attractive regional studies of the kind yet published.⁴⁴ At the outset he draws attention to a well-marked climatic boundary which transgresses the physiographic lines, separates his regions into two groups, and modifies otherwise similar regions. Relief being here highly accentuated, the size of the regions determined by configuration is correspondingly diminished. The regions he distinguishes are prolonged around the Alpine curve past the Lakes of Geneva and Constance. Blanchard delimits his regions clearly on the map and provides a certain amount of statistical information, which indicates that the density of population varies markedly from region to region.

NATURAL DISTRICTS

These are the smallest of the natural regional subdivisions and are the most important for our present purpose. Lucien Gallois has concerned himself largely with them and has found them to correspond broadly with the old *noms de pays* of France. For the most part they are small regions with a marked individuality, owing primarily to the uniformity of their geological foundation.⁴⁵ Gallois, however, held reservations upon their capacity for satisfactory delimitation.

Locussol has treated the Velay district in the same way.⁴⁶ He takes geology as the basis of his description of the country and finds it divisible naturally into a number of *petits pays*, which show recurrent types, which he unifies into the basaltic, phonolitic, granitic, etc., regions. All are unified on physiographic grounds, the plateau being the form which exerts the broad influence in the country. The paper is illustrated by geological sections, but the regions are not mapped. This study is of further interest in its anticipation of the synthetic method proposed by Unstead, which will be mentioned subsequently.

Leriche treats Belgium in exactly the same way, even to the extent of identifying the *noms de pays* with the natural districts. He states "les limites de ces régions naturelles . . . correspondent aux limites des formations géologiques et . . . ces régions tiennent leur caractères physiques de la nature et de l'allure des couches qui composent leur sous-sol."⁴⁷ A knowledge of Belgium shows that these small geological regions may be grouped easily into larger physiographic provinces which extend beyond

⁴⁴ *Idem*: The Natural Regions of the French Alps, *Geogr. Rev.*, Vol. 11, 1921, pp. 31-49.

⁴⁵ Lucien Gallois: Régions naturelles et noms de pays: Étude sur la région parisienne, Paris, 1908; *idem*: Les noms de pays, *Ann. de Géogr.*, Vol. 18, 1909, pp. 1-12.

⁴⁶ Eugène Locussol: Les régions naturelles de Velay, *Ann. de Géogr.*, Vol. 17, 1908, pp. 105-127.

⁴⁷ Maurice Leriche: Les régions naturelles de la Belgique, *Rev. de l'Université de Bruxelles*, Vol. 19, 1913-14, pp. 175-217.

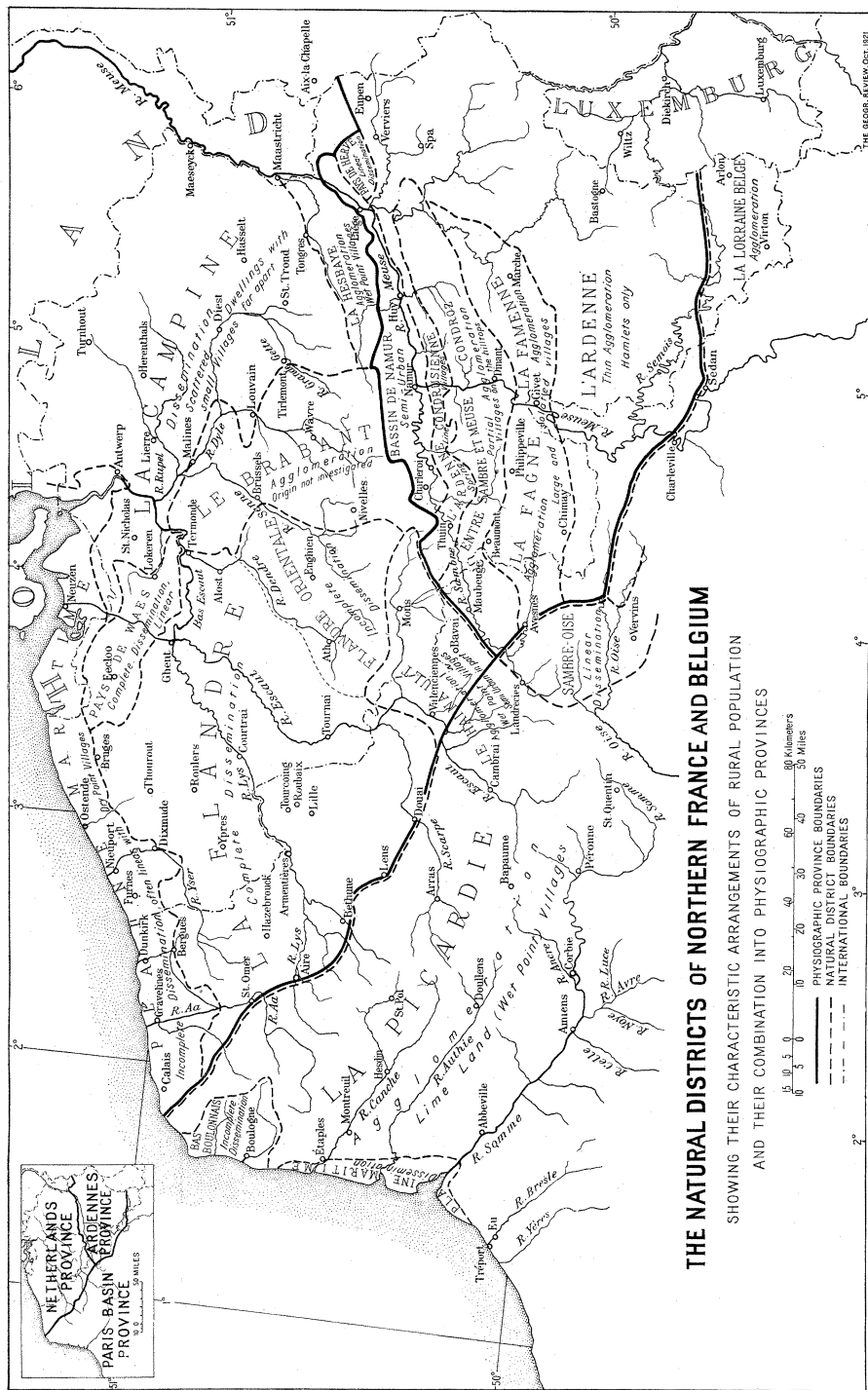


FIG. 5.—Map showing the natural districts of northern France and Belgium with the characteristic arrangements of rural population and the relation to physiographic provinces (identified by name in inset map.) Scale approximately 1:2,100,000.

the confines of Belgium. Leriche's own regions of course do not stop at the Belgian frontier.

It is now fairly evident that the term "natural region" represents a different idea to different men. The ideas harmonize well with the degrees of status here proposed for natural subdivisions of the land. It is not actually claimed that x natural districts = 1 physiographic province and that y physiographic provinces = 1 climatic region. The argument is that the four classes of regions proposed are of markedly *different status* and that the smallest units are capable of being grouped into larger assemblies, which will enable a more correct assessment of the larger units to be made. It does not necessarily follow that a group of the smaller units would correspond exactly to the delimitation of the higher unit, but it would be expected to correspond fairly closely with it. In grouping natural districts into physiographic provinces a close correspondence may be expected; but the union of the latter into larger groups need not necessarily correspond very closely to the limits of the climatic region. The higher the region the more zonal will be the character of the boundary, and there may be some transgression of physiographic by climatic boundary zones. The synthetic method, however, should help materially in the more exact delimitation of the higher units. This is the method proposed by Unstead.⁴⁸

It will be noted that the authorities I have quoted have not attempted to delimit natural districts. I do not think that this is any indication that these districts are not capable of delimitation, if we keep in mind the zonal character of the boundaries. When once we are able to indicate the broad areas on our maps, careful geographical survey should serve to narrow the tentative zones considerably, and the ultimate *lines* of demarcation should agree well with the facts.

HUMAN REGIONS

The regions which Fleure has recognized⁴⁹ under this heading have great significance in any study of population. Free from the complication of considering innumerable factors like those involved in the delimitation of the previous regions, these broad generalizations indicate clearly the fundamental relations of man to the earth. Their connection with the natural regions is not yet evident, but the gradual completion of the regional map will probably show close correspondence between the two types. I propose to add another type to Fleure's list, the regions of strife, to which I made allusion in my former paper.

REGIONS OF STRIFE

These regions, by reason of their situation, are the traditional areas of epoch-making conflict. They are either lands of easy movement or command

⁴⁸ J. F. Unstead: A Synthetic Method of Determining Geographical Regions, *Geogr. Journ.*, Vol. 48, 1916, pp. 230-249.

⁴⁹ H. J. Fleure: Human Regions, *Scottish Geogr. Mag.*, Vol. 35, 1919, pp. 94-105.

lines of comparatively easy movement; and they lie between regions of diverse character which place things of general need or desire either under rival control, often of unequal power, or between peoples of incompatible racial and national aspirations. Battles have been fought all over Europe, but many of them have been the results of deep penetration after one party has gained command of a region of strife. Ordinarily the regions of strife are the theaters of decisive events. The Latin-Teuton boundary zone of western Europe, particularly the Netherlands; the Slav-Teuton boundary zone of eastern Europe; the outer flanks of the Carpathian-Balkan arc; Piedmont and Istria; Macedonia and the Hellespontine region; the lowlands of Palestine; the border of the grasslands on the upper Nile; upper Mesopotamia; the zone between the Indus and the mountains to the northwest; and Manchuria—these are the more prominent zones of strife.

Application

These considerations have taken us a long way from the expansion ratio. We may now review the position. In the first place a rural population based on agricultural and pastoral pursuits may be accepted as a fundamental element in world development. Therefore the first attempt at the evaluation of the ratio must be based on the rural population. It is necessary to find out how many farms each natural district will maintain at its utmost occupation. To this there is a limit for each district. The ultimate limit is reached when we have that state of subdivision which just enables the occupant to support himself and his family by his efforts. This would leave no surplus of production, and no urban population would be possible. The limit we require is that state of subdivision which enables each holder to live at a standard comparable to that of the present. Secondly, there is a limit to the number of sites either for individual dwellings or for groups of dwellings in each district. This may be imposed by geographical conditions or may be deduced from space economy by regarding the sites as the nodes of a network. The latter case is applicable where conditions, particularly of ground water, impose no restrictions on the choice of sites. This limit may also be obtained if the appropriate grouping be already in existence; if it is not, allowance must be made for its ultimate development. The basic consideration is the size of the holding permissible to the area, and the change to be brought about will depend upon the system of land tenure.

In order to have some quantitative guidance it is necessary to select a few districts as standards of reference. Flanders appears to me to be a district with a ratio already approaching unity. Shantung is an example of what is to be avoided. According to generally accepted figures for the census of 1910 the population of the province is about 500 per square mile;⁵⁰ but, when allowance is made for the extensive mountainous area, the population

⁵⁰ W. W. Rockhill: The 1910 Census of the Population of China, *Bull. Amer. Geogr. Soc.*, Vol. 44, 1912, pp. 668-673.

of the lowlands (part of which is uninhabitable salt desert) must be of excessive density. Individual instances where the land is occupied at the rate of 3,000 persons per square mile are given by King.⁵¹ Moreover, apart from standards of this kind, as natural districts become known they will probably show recurrent types, just as some climatic regions have their homoclimes. The information gained from one region may be applicable to others. Caution is needed in dealing with regions which are very much alike, however; I have shown elsewhere that two geographically comparable regions may be developed by man along very dissimilar lines,⁵² the difference in the example given—dealing with chalk lands—being due mainly to original forestation and to the relations to surrounding districts. Were this scheme applied to one small country (say Belgium) where the natural districts are well defined and the grouping of population shows clear-cut variation from district to district, we should have a valuable piece of quantitative knowledge on which reliable estimates could be based. It is not possible for one man to carry out such work, the co-operation of economists and agriculturists being required; nor could it be done very quickly; but some investigation of the kind must be undertaken to enable us to realize the state of affairs. It involves the survey recommended by Mill and Dickson, and it is the best method of stock-taking advocated by the latter. The regional survey movement in Britain of which Patrick Geddes has been the leading spirit is a step in this direction.⁵³

If we ascertain the ultimate limits of expansion of our rural peoples in this way, we also acquire data bearing upon the ultimate surplus of food supply. This enables us to deduce what proportion of urban folk may eventually be capable of development. It is a far remove from this to the control of city growth, but it is not a stretch of imagination to say that both the number and the size of cities must have some maximum limit. This limit is intimately related to the limit of food supply. There is another limitation which may assist in arriving at more definite conclusions, and it is to be deduced from the fact that the number of possible positions for cities is a comparatively small one. A study of Blanchard's map of the French Alps⁵⁴ will probably convince one that no more towns of importance are likely to arise in the region. The nodal points are already occupied. A military staff officer in studying a natural district would very likely have little difficulty in marking on his map the positions and number of critically nodal points.

If asked how one should set to work in order to ascertain the expansion ratio of a country I would submit the following scheme as a feasible one. A geographical survey of the country should first be undertaken, in order

⁵¹ F. H. King: *Farmers of Forty Centuries, or Permanent Agriculture in China, Korea and Japan*, Madison, Wis., 1911.

⁵² M. Auroisseau: *A Contrast in Chalk-Lands*, *Scottish Geogr. Mag.*, Vol. 36, 1920, pp. 158-161.

⁵³ The progress of the regional survey movement has been followed in the *Geographical Teacher*. Among other papers see "A Conference on Regional Surveys," *Geogr. Teacher*, Vol. 8, 1915-16, pp. 89-96 and 164-172.

⁵⁴ *Geogr. Rev.*, Vol. 11, 1921, p. 33.

to delimit the natural districts on geological grounds. It is not my contention that every outcrop should be mapped as a separate geological district. Indeed, for this reason, Fèvre and Hauser reject geological subdivision in their treatment of France from the regional standpoint, on the grounds that it is an "atomisme géographique."⁵⁵ Leriche and Blanchard have set an admirable standard, in their treatment of Flanders, for the degree of geological unity to be aimed at. The boundaries of the natural districts should be mapped, and each district should then be treated as a unit, in the following manner: the grouping of the rural folk should be studied in detail, and the local controls established. It is necessary to determine whether or not the grouping is a full geographical expression and, if not, what form of change is likely to operate. All dwelling sites and potential dwelling sites should be mapped. The hydrology of the district therefore requires thorough study in order to determine the potential and actual "water points." The land under forests and farms should be mapped, and the land capable of being farmed is also to be marked out. Land under urban occupation or absorbed in railways and roads must be indicated. Field study of the size and nature of the farms, and of possible changes in the kind of agricultural or pastoral pursuits must be made. It is also necessary to map the critically nodal points of the district, as potential urban positions, and to determine from field study whether or not the existing towns and cities of the district are likely to experience decline or rejuvenation. With this information, the survey may now turn to the statistical records of the region and apply them in an office study. The smallest administrative subdivisions must be recognized as the basis of treatment here; but they are usually much smaller than the natural district (parishes and communes of Europe, for example) and can be grouped so as to correspond closely enough with the natural districts. It may be necessary, however, to use statistics compiled by different authorities and on different bases; but this is unavoidable until administrative units have some semblance of correspondence with geography. The productivity of the forests needs study; and the amount of land per capita which must be maintained under forests must be determined. From the productivity of the farms the size of the average workable farm may be determined; and from this and from the surveyed information the possible extensions of farming may be deduced. Here it is necessary to make cautionary corrections for the amount of forested land the ultimate rural population will require and for the amount of pasture the ultimate number of farm animals will require. Allowing for these corrections, the ultimate capacity of the region is ascertainable, provided the field survey indicates that suitable dwelling sites, under an appropriate grouping, exist for the number of families deduced from the calculations entailed in the above work. Balancing up these factors, we have the rural expansion ratio for the natural district under consideration. The study that the geographer will have made of land tenure in the district

⁵⁵ Joseph Fèvre and Henri Hauser: *Régions et pays de France*, Paris, 1909, p. 10.

will enable him to formulate any administrative measures necessary to effect desirable changes in the district. Reliable deductions, however, do not end here. Knowing the ultimate rural capacity of the district, we also have information on the possible surplus of food production; and from this may estimate the possible limits of urban growth. If it appears from the estimate that new towns are likely to arise, the nodal points of the district having been mapped, the best positions for new towns can be indicated with confidence.

The method of work may be expected to vary somewhat from district to district and must be learned largely by actual experience, just as the geological surveyor in a new area has to make an extended reconnaissance before he is able to decide on the best method of attack and treatment.

Maps

Good maps are badly needed, but three maps of a special kind seem to me desirable. The making of them calls for the establishment of geographical surveys organized in a similar way to our geological surveys. We need an "earth-material map," a power map, and a lowland map.

THE EARTH-MATERIAL MAP

The rocks of the earth are of paramount human importance. The geologist finds it necessary to map formations which are of no use to the geographer. What we require is a type of map showing the following features: areas of deep drift soils, such as the glacial clays and the great plains of accumulation; areas of residual soils and the distributions of the rocks from which they are derived, such as granites, basalts, limestones, chalks, shales, slates, alternating strata, unconsolidated beds, etc.; hydrological information; coal and petroleum districts; locations and kinds of metalliferous and other economic deposits. These are the significant things. It is far more important for us to know that an area is an expanse of thick, flat-bedded sandstone than it is to know that it is a region of "Upper Triassic sediments."

THE LOWLANDS MAP

The ordinary orographical map accentuates the highlands, which, from the point of view of human occupation, are unimportant. Let us reverse the scheme and accentuate the lowlands and see at a glance where the great masses of men are likely to live. A small intermontane basin makes a poor showing on the ordinary map, but if the colors be reversed it stands out at once.

THE POWER MAP

The most important factor in the distribution of mankind, apart from earth material and climate, is power and the sources of power. These

should be specially mapped, due regard being paid to sources of wood fuel, wind power, water power, coal and oil, and hydro-electric power. It is quite likely that we shall discern power boundaries and regions characterized by different power possibilities. Again, we may be forced to revert to the obsolete sources of power to some extent.

The history of power for industrial purposes falls naturally into four periods, or phases of development. The first involves the use of manual or animal power; the second that of wind, water, and wood fuel; the third that of steam and electricity, both of which are primarily dependent on coal; and the last is just emerging as the internal combustion (oil) and hydro-electric age. The transitions from one source to another involve great movements of mankind.

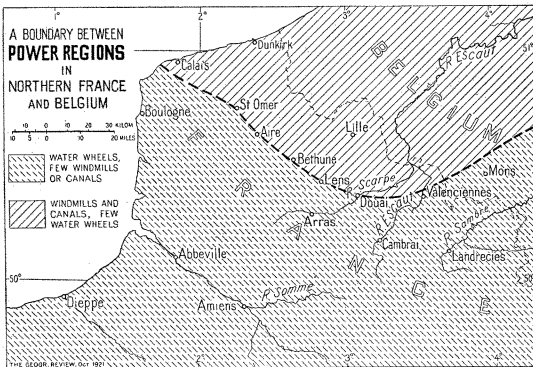


FIG. 6—An illustration of power mapping; the boundary between regions of water power and wind power in northern France and Belgium

Windmills and water mills are a relic of the second age; but, like wood fuel and manual labor, in many places and mainly owing to their cheapness, they still survive for local use or for special purposes. It is improbable that the sailing ship or the windmill will ever disappear entirely from use. Water mills, being much more reliable and constant than windmills in their work, are

used in preference to the latter wherever possible.

Owing to the configuration of northern France windmills and water mills have a well marked regional distribution. In French Flanders and extending away into Belgium, Holland, and Denmark is a flat and monotonous country where the streams are sluggish and are best used as canals for barge traffic. The wind, however, gathers force as it sweeps over the flat expanses and on every tiny knoll is caught in the sails of a mill that grinds the local grain. North of the Scheldt (in France) the water mill is practically unknown. Southwest of the line St. Omer-Aire-Béthune-Douai-Valenciennes the situation is entirely different. Here we have the undulating area of the chalks, stretching away into Normandy, Picardy, and the Champagne—a region of small but swift streams draining into large and lazy rivers. The small streams are studded with water mills which work almost throughout the year, and barge traffic is confined to the lazy rivers. There are a few scattered windmills in the region, for villages exist far from the streams where the chalk expands into small plateaus. The whole region is, nevertheless, one of water mills and produces flour in plenty for local use.

The Ethical Problem

We talk a great deal about an urban exodus, but the townsman shows little inclination to take to permanent country life. Before such an exodus can take place life in the country must become as attractive, in satisfying the higher needs, as life in the towns. Town life is community life developed to a high degree, but the old community spirit has disappeared almost completely from the country, leading to what is termed in England "the problems of village life." Until some of the old spirit is again infused into the country no exodus from the city is likely to take place. Community ideas appeal to the mass of mankind, and experiments in communism have been made even in America.⁵⁶ A movement is now on foot which, if successful, should do a great deal for country life by creating community interests and providing means for their prosecution.⁵⁷

Our concern from this point of view is more with the "country planning" suggested by Dickson. Human interest is rarely absent from the landscape in any settled country. Dwellings and villages, the construction of roads, railways, and canals, the planting or removal of forests, hedging and ditching, engineering structures and works, and the mere outlines of farms all contribute to the making of the average landscape and in time mellow into it. The results are often extremely pleasing but are sometimes quite the reverse; yet how simple is the process of making a building or an engineering structure artistic or attractive without sacrificing its efficiency or increasing its cost! The contrast between the bridges of London and Paris is an example, not without individual exceptions on both sides; but the balance is greatly in favor of Paris. A satisfactory broad effect may be produced unconsciously, as in many parts of rural England; or by conscious effort, though not necessarily directed to this end, as in rural France. Rural England is generally preferable to rural France, owing to the relatively slight interference with what is left of nature.

Flanders offers an example of extreme formality, the result of its flatness and intense agriculture. A checkerboard effect has been produced by the rectangularity of roads, hedges, and ditches and by the planting of rows of trees; while monotonous regularity results from the lopping of the lower boughs of the trees and the constant repetition of the same house type, every red cottage having its duck pond, and by the straight reaches of the canals. The untrammelled expression of nature is confined to the roadsides and ditches. Nobility has here been sacrificed for prettiness; and the lack of freedom is somewhat stifling to one accustomed to more open country. It is almost impossible to ride off the road in Flanders.

This aspect of scenery is of more than sentimental importance; as scenery is a feature capable of great modification by man, the more urgent is the

⁵⁶ W. A. Hinds: *American Communities*, Oneida, N. Y., 1878.

⁵⁷ See publications of the National Community Board, Washington, D. C.; also, Dwight Sanderson: *Country-life Forces Mobilizing*, *Review of Reviews*, April, 1921, pp. 421-425 (an account of the activities of the National Council of Rural Social Work).

necessity that its evolution be well guided in order that the best may be made of our physiographic foundation. The argument for the influence of surroundings might be elaborated to an infinite extent.

The French geographers have made important contributions of the kind required, in studying the morphology of the house and village, which varies regionally like that of the town. These efforts, which have a bearing upon the construction of the right kinds of houses, should be extended to various climes.⁵⁸

Information

If important results are achieved in this section of geography it is necessary that they be incorporated in the common stock of knowledge more promptly than are most technical studies, in order that the prevailing ignorance on the subject of population may be removed. Sosman has shown that the distribution of scientific information falls far behind the production of the information and has reviewed all the present means of distribution.⁵⁹

Geographical science is in a more favorable position to achieve distribution than most other branches, owing to its general interest and appeal. Some improvement might be made, however, by more direct guidance of teaching in schools, colleges, and universities. The geographical associations are powerful enough to have a large share in planning the curriculum for instruction. If they would do their share, they might ensure a more rapid distribution of the great principles which rise readily to the surface of the sea of minor results of research. The map is another powerful means of spreading information, and I would suggest a scheme somewhat like deliberate advertising by means of lucid maps. The eye takes in a great deal of information in properly co-ordinated form from maps, especially if the central idea which the map is intended to convey be expressed also in a pithy and prominently printed sentence. The London Zoo has done much to popularize itself by its scheme of advertising, and the attractive advertisements displayed in the London underground railways are interesting in themselves. It is possible for the geographical societies to devise a scheme for the distribution of information by advertisement which would reach the adult and so keep the general public well informed in a way that is impossible if we work through schools alone. Knowledge carried from school is likely to be many years out of date where the adult is concerned. The success of the *National Geographic Magazine* assures us of a large audience desirous of receiving interesting information attractively presented and warrants an attempt being made in the way suggested. We may yet see the properly accredited poster map achieving for geography that result which all branches of science desire, the existence of a public not only provided with the correct information but also knowing the why and wherefore of the facts and therefore desirous of utilizing them.

⁵⁸ See Paul Privat-Deschanel; L'habitation humaine dans le Sénonais, *La Géographie*, Vol. 16, 1907, pp. 209-224; Jean Brunhes: La géographie humaine, Paris, 1912, Ch. 3; Albert Demangeon: L'habitation rurale en France, *Ann. de Géogr.*, Vol. 29, 1920, pp. 352-375.

⁵⁹ R. B. Sosman: The Distribution of Scientific Information in the United States, *Journ. Washington Acad. of Sci.*, Vol. 11, 1921, pp. 69-90.